

From boatanchors@theporch.com Thu Mar 2 12:15:11 1995  
Date: Thu, 2 Mar 1995 09:17:09 -0600  
Message-Id: <199503021520.KAA113021@ee.duke.edu>  
From: "Rhett T. George" <rtg@ee.duke.edu>  
Subject: <didn't bother with a subject>

- Hi, B-A Friends -  
Two recent communications lead me to present these comments.

George was reminiscing about core memory and the DEC PDP-11. I know many of us remember that the space shuttle Challenger carried computers which used core memory because those computers had been rated for manned flights.

Alan asked about triodes vs multigrid tubes. Triodes have a fair bit of capacitive coupling to the plate. At high frequencies (maybe 10 kHz, certainly 10 MHz, depending on the tube and the application), a current which must be considered will flow from the plate back to the grid thru this capacitance. The tetrode offers a second grid which acts as an electrostatic shield to virtually eliminate this capacitance. It may reduce the control grid to plate capacitance two orders of magnitude. The tetrode has its own problems with certain plate metals which have high secondary emission. To get around this, the (secondary electron) suppressor grid was added to make the pentode.... Fix, Fix, Fix.

The cascode connection came along during or just after WW II and is a circuit design which makes high frequency application of triodes much easier.

73 Rhett George - KE4HIH

From boatanchors@theporch.com Thu Mar 2 22:12:57 1995  
Date: Thu, 2 Mar 1995 19:56:42 -0600  
Message-Id: <9503021754.AA18204@batman.rock.gtegsc.com>  
From: okas@batman.rock.gtegsc.com (Bob Okas)  
Subject: <didn't bother with a subject>

Greetings to the Filamentary-Gifted,

I have the opportunity to acquire several pieces of Hallicrafters gear so I thought I'd consult the Net Oracle for advice. I have said units in my possession (the car trunk) and haven't had the chance to check them out yet. Pending go/no-go evaluation, I'm soliciting feedback as far as fair market value is concerned.

The first item is an HT-40, that's dirty and has a few scratches on the case. Something is loose inside, but it appears to be complete otherwise. All knobs but one appear to be original. (Dang, I forgot where I put the BA rating scale...) Operational status is unknown.

The next is an S-27 "UHF" receiver, dated in the mid-40's with a Navy nomenclature plate. It's said to be operational. The plastic dial windows are warped and yellowed with age but the front panel looks decent. Not too dirty either.

Last is an SX-25 "Super Defiant" (Love the name) receiver. This one falls in the "operationally challenged" category. Knobs are missing; Bandspeed dial bezel is cracked and half of it is missing; S-meter missing, as is most of the bezel; Also one or two tubes are missing. I must be either a hopeless romantic or a masochistic fool, but I feel a strange attraction to this one.

Thanks,

Bob - N3MBY

From boatanchors@theporch.com Thu Mar 2 09:27:06 1995  
Date: Thu, 2 Mar 1995 07:04:33 -0600  
Message-Id: <9503021308.AA23308@internet1.lotus.com>  
From: Alan Richer <Alan\_Richer.LOTUS@crd.lotus.com>  
Subject: All right, explain me this.....

OK, guys, back into the theory for a bit....

A tube with three elements (a triode) conducts from cathode to plate, with the conduction controlled by the voltage level present on the grid. OK? OK.

Well, then, why multigrid tubes? Wouldn't it be possible to do it all by just tying the various bias voltages and such onto 1 grid, perhaps with capacitive coupling?

Bit-rotted minds want to know..... -ajr N1TWY, ex-WA1YHY

From boatanchors@theporch.com Thu Mar 2 09:27:22 1995  
Date: Thu, 2 Mar 1995 07:03:57 -0600  
Message-Id: <9503021308.AA23300@internet1.lotus.com>  
From: Alan Richer <Alan\_Richer.LOTUS@crd.lotus.com>  
Subject: All right, explain me this.....

OK, ladies and gentlemen, back into the theory for a bit....

A tube with three elements (a triode) conducts from cathode to plate, with the conduction controlled by the voltage level present on the grid. OK? OK.

Well, then, why multigrid tubes? Wouldn't it be possible to do it all by just

tying the various  
bias voltages anbd such onto 1 grid, perhaps with capacitive coupling?

Bit-rotted minds want to know..... -ajr N1TWY, ex-WA1YHY

From boatanchors@theporch.com Thu Mar 2 10:48:44 1995  
Date: Thu, 2 Mar 1995 08:10:55 -0600  
Message-Id: <m0rkBdu-000uHGC@twisto.eng.hou.compaq.com>  
From: Dave=Sharp%Legal%Corp=Hou@bangate.compaq.com  
Subject: re: All right, explain me this.....

I remember that although triodes are neat, the tetrode has a better grid to plate capacitance thus is more stable. It probably makes a better detector also because of the lack of need for carefully tuned circuits.

Pentodes have an additional grid to stop the secondary emission from the plate and thus the "dip" in plate current when you slide the tube thru the current/voltage knee.

Now in some circuits the screen grid is tied to the plate to make the circuit better for class B service. There are lots of variations here depending on the need, the voltages involved, and the internal dimensions of the tubes involved.

Dave Sharp  
Houston, TX USA  
dave=sharp%legal%corp=hou@bangate.compaq.com  
Someday when they move to space, they'll need us firebottle types.

From boatanchors@theporch.com Thu Mar 2 21:51:54 1995  
Date: Thu, 2 Mar 1995 10:31:42 -0600  
Message-Id: <199503021634.LAA17619@Shiva.COM>  
From: John Shriver <jas@shiva.com>  
Subject: Re: All right, explain me this.....

Multigrid tubes greatly reduce the capacitance from grid to plate, allowing operation at far higher frequencies.

Moreover, the effect of the grid-to-plate capacitance (in triodes) is greatly increased by the Miller Effect. Since the plate voltage (in grounded cathode operation, which is normal) moves oppositely to the grid voltage, it has the effect of making that capacitance look much larger. In effect, the capacitance is multiplied by the gain of the tube. This makes the grid look pretty much like a dead short to ground at high frequencies.

So, there was the screen grid. However, the screen grid has it's own foibles, being at a high voltage. So they added a supressor grid, which is grounded, to keep the screen grid from messing with the plate.

At that, they had the pentode, and that's about the limit for conventional tubes.

Before screen grids, 2 MHz about was the practial upper limit for triode tube operation. That's why the AM broadcast band is below 2 MHz...

This is why everyone should have a older copy of the Radio Amateurs Handbook, before it was all solid-state, theory-wise.

From boatanchors@theporch.com Thu Mar 2 22:30:24 1995  
Date: Thu, 2 Mar 1995 10:36:05 -0600  
Message-Id: <m0rkDih-0007PCC@beacons.cts.com>  
From: Kevin Sanders <kevin@beacons.cts.com>  
Subject: Re: All right, explain me this.....

> A tube with three elements (a triode) conducts from cathode to plate, with the  
> conduction  
> controlled by the voltage level present on the grid. OK? OK.  
>  
> Well, then, why multigrid tubes? Wouldn't it be possible to do it all by just  
> tying the various  
> bias voltages anbd such onto 1 grid, perhaps with capacitive coupling?  
>  
> Bit-rotted minds want to know..... -ajr N1TWY, ex-WA1YHY

As another bit-rotted mind, attempting to answer these questions and then potentially being corrected later helps me learn better than just waiting for the answer. So I apologize to the list for wearing my ignorance on my sleeve, but here goes...

In a mixer circuit the signals being mixed may have wildlly different voltages. A local oscillator signal will be orders of magnitude larger than the desired signal coming out of the RF amplifier. Yet to achieve proper mixing the two signals need to be on equal footing in terms of modulating the tube's conduction. This equal footing can be achieved by using different amounts of capacitive coupling for the two signals and applying each to a separate grid.

If you tried to use a single-grid triode as a mixer, the mixing would be occurring \*outside\* the tube, in the coupling circuitry. One of the coupling capacitors would absorb the majority of the signal from the

other one, and the grid would only see a single signal. Hence no mixing.

Now some questions that my "explanation" bring up in my own mind: in a multigrid tube, don't the impedances seen by the different grids need to be the same? Are different values of coupling capacitors sufficient to provide this impedance match, or is different grid bias or perhaps transformer coupling also needed? Can multigrid tubes handle different grid biases?

Let's see, one answer which may be totally off base, followed by three questions. At this rate this thread will never end ;-)

73,

Kevin Sanders, KN6FQ (SDG)  
kevin@beacons.cts.com

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From boatanchors@theporch.com Thu Mar 2 22:43:19 1995  
Date: Thu, 2 Mar 1995 19:34:32 -0600  
Message-Id: <199503021817.MAA11859@zoom.bga.com>  
From: Henry van Cleef <vancleef@bga.com>  
Subject: Re: All right, explain me this.....

As Alan Richer said

>

> Well, then, why multigrid tubes? Wouldn't it be possible to do it all by just

> tying the various

> bias voltages anbd such onto 1 grid, perhaps with capacitive coupling?

>

You'll find discussions in Ghirardi, "Radio Physics Course," and  
Spangenberg, "Vacuum Tubes."

Early triodes (01A, V99), had gain, but very low plate resistance and a lot of grid-plate capacitance. The effect of the capacitance was multiplied by any voltage swing on the plate. The combination produced low stage gain and a need for neutralization to prevent oscillation in amplifier stages.

Adding a "screen grid" between the control grid and the plate did two things:

a. As a Faraday shield, it isolated the plate capacitance from the control grid.

b. As an acceleration electrode, it pulled the electrons from the cathode (think of the cathode as an NPN "emitter") with a constant field. Cathode current became relatively insensitive to plate voltage as long as the plate voltage was high enough to collect what came through the screen.

The signal-amplifier tetrode best known was the UY224, or "24." This tube dates from around 1929.

There was one profound and unfortunate side effect to this. The kinetic energy of the accelerated electrons produced secondary emission, and if the plate voltage dipped much below the screen, this produced a significant current from the plate to the screen, and a dip in plate resistance. If plate voltage was reduced further, the plate slowed the electrons sufficiently to reduce secondary emission, raising dynamic plate resistance again. The result was a negative resistance region in the plate circuit, and with too much signal into the circuit, an amplifier would take off like a big bird and oscillate.

One "fix" was to treat the plate metal so that it would not emit so many secondary electrons. The 24A is a 24 built with a treated plate. It went into production around 1930.

To fix this side effect, an additional "suppressor" grid, generally run at cathode potential, was installed to repel the secondary electrons. This took the negative resistance "hook" out of the plate resistance. This fix was introduced around 1932, originally in a 47 power tube. You'll note that Ghirardi doesn't think much of pentodes as signal amplifiers, and predicts that they won't become common.

It is interesting and amusing to read the old engineering literature and see the variety of descriptions of the value (or lack thereof) of screens and suppressors. Spangenberg's treatment is probably the best for any detailed study of vacuum tube physics. It is also a bit amusing to see that all the old texts treated the equivalent circuit of a vacuum tube as a voltage generator with the plate resistance in series, rather than a current generator with the plate resistance in parallel. When I taught courses in "transistor design for tube engineers" in the late fifties and early sixties, I began by presenting the pentode as a current generator, with a grid leak resistor, so that it could be viewed as a device that produced current gain similar to a transistor. Of course, a FET looks much more like a pentode on its input and output circuits, without the benefit (or nuisance) of having a screen and suppressor circuit to consider.

Inasmuch as the screen and suppressor are both "grid" elements, generally installed as wound helices in the path of the electrons, they have their own transconductance. Screen modulation of transmitter finals is fairly well-known, as is the use of the screen circuit to control power output by setting the DC level on it. Beam tetrodes use beam forming plates instead of a suppressor, and are generally made with the screen wires aligned with the control grid to reduce the screen current. These date from about 1936 (6V6, 6L6, 807), and are a

study of their own beyond what I've said here. Compared to a pentode (6F6) their plate resistance stays flat down to a lower voltage.

I'll only comment quickly on the converter tubes with two specific control grids. The 2A7/6A7 was the original design, a tetrode with an additional control grid and pseudo-plate (actually, two grid rods with no wire on them) added inside, for use in an oscillator circuit. Works fine for standard broadcast, wretched much above that. One big problem was the transit time between the two control grids and the interaction between them.

The 6SA7 eliminates the oscillator pseudo-plate and adds a suppressor grid. Normally used with a grounded-plate oscillator circuit, and has much less trouble at higher frequencies, although keeping the oscillator excited with feedback through the cathode circuit is a problem.

The 6L7, 6K8, and 6J8 were "solutions" to oscillator/signal circuit interactions. 6L7 as designed to have a separate local oscillator driving the outer control grid (sharp cutoff). 6J8 has a local oscillator built into a 6L7-type tube with the triode and heptode outer grid interconnected. 6K8 was built as a common cathode with a triode structure on one side, heptode on the other, triode grid internally connected to the inner control grid. All three give the designer some freedom to consider local oscillator design separately from the mixer.

--

\*\*\*\*\*  
Hank van Cleef vancleef@bga.com vancleef@tmn.com  
\*\*\*\*\*

From boatanchors@theporch.com Thu Mar 2 23:47:13 1995  
Date: Thu, 2 Mar 1995 10:03:12 -0600  
Message-Id: <Pine.3.89.9503020721.A13197-0100000@netcom5>  
From: paul Veltman <veltman@netcom.com>  
Subject: Re: All right, explain me this.....

>  
> Well, then, why multigrid tubes? Wouldn't it be possible to do it all by just  
> tying the various  
> bias voltages anbd such onto 1 grid, perhaps with capacitive coupling?

Oh my aching anode. Well, sir, this is the way my analog mind sees it. Triodes were OK, but to get a high amplification factor, you needed to back the plate away from the grid, thereby reducing the plate current and necessitating a high plate voltage. The Tetrode was developed to get a high mu tube without the above problems and more important, to get lower

grid plate interelectrode capacitance. The Pentode, with the addition of a suppressor grid that is at ground or negative potential was developed primarily to eliminate secondary emissions caused by the high electron velocity from the grid to the plate.

Enough for the short answer. There are probably 300 more people that know more than I do about it on this list, so I'll let them take a shot, or I'll write more when I have the time. :-)

73

Paul WA6OKQ, WPE6FQE, 12Q1939 (any of you guys old enough to recognize the last one??)

From boatanchors@theporch.com Fri Mar 3 02:33:12 1995  
Date: Thu, 2 Mar 1995 23:50:56 -0600  
Message-Id: <199503021728.LAA20448@quake.xnet.com>  
From: mshaum@xnet.com (Mark Shaum)  
Subject: BA Archive Site? Where?

Now that I allowed my offline mail reader (Eudora) to re-index my BA messagebases, (necessary after a SLIP hangup while polling for new mail) I've lost a lot of the last months worth of postings, and more importantly, the nice December series on refinishing wrinkle cabinets.

I believe there is a site (outside of theporch.com) that is maintaining the BA digests for 'back issue' reading? Are these available by day, week, or what, and above all, where from? I'm assuming they are on a FTP site somewhere, but I'll manage whatever connectivity is required to restore my articles..

73! - Mark, NE9G

From boatanchors@theporch.com Thu Mar 2 11:09:23 1995  
Date: Thu, 2 Mar 1995 08:25:13 -0600  
Message-Id: <9503021428.AA22575@nwd2sun1.analog.com>  
From: David Upton <David.Upton@analog.com>  
Subject: Re: BOATANCHORS digest 76--matched tubes

>

> I wonder about this too and have asked several people over the past few  
> years. More than one has said that "matching" involves taking tubes from  
> the same production run and line. No one seemed to know what tube  
> characteristic is used to put together a set from different runs.

>



I think this is the right answer, but I will defer to other more knowledgeable folks on the list if I'm full of hot air...

The gain of the tube is what needs to be matched. Even the same run may produce tubes with different amplifying characteristics. If the tubes are not matched, parallel output circuits will cause one tube to work harder than the other if there is no separate grid bias adjustment. You want the plate currents to be equal across the pair, and adjusting grid bias separately is a way to achieve this. Circuits which do not allow for this separate grid bias adjustment require matched tubes.

73,  
Kevin KN6FQ

-----  
In a small-signal sense, the transconductance needs to be matched for the tubes to share the load equally. In a large-signal sense, I-V characteristics and curvatures need to be identical since the transconductance by itself is not well-defined. Many fellows pointed out that the often-abused sweep tubes being run way above "normal" ratings tend to have problems. Adjusting drive levels or biases on the tubes is one way to "force" unequal tubes to work together. My preferred method to tame these little sweep tube eaters (little cheap linears sold to hams who ought to know better...) is to insert a few ohms of cathode resistance on each tube to provide some local degeneration and protective bias. These can be by-passed to prevent loss of gain if you wish. Professional equipment often provides a screen voltage adjustment or individual control grid bias voltages as well as monitoring of each tubes' currents. These are good ideas to incorporate in any HB design so that the end user is not stuck. Mixing tubes of different manufacturers is not a good idea as the uniformity of mechanical design (spacing of elements, pitch of grid wires etc.) is largely responsible for the overall curvature in the I-V characteristics-especially at large signal levels. Providing series resistance with each grid is not a cure-all and depends on the circuit configuration. It probably works fine with class B circuits at RF and possibly AF but I don't want to generalize and say it is OK for everything. The current sharing problem is far more intense in semiconductors so very few paralleled discrete unmatched devices are used.

David M. Upton, WB1CMG  
David.Upton@Analog.com

From boatanchors@theporch.com Thu Mar 2 22:31:29 1995  
Date: Thu, 2 Mar 1995 19:08:47 -0600  
Message-Id: <199503030042.RAA10561@Freenet.HSC.Colorado.EDU>  
From: al511@freenet.hsc.colorado.edu (Robert Neece)  
Subject: Carl & Jerry; WPE "callsigns"

Mike Knudsen writes:

>I do remember C & J finding that YL in the steam  
>tunnels under Parvoo U., which bore a strange resemblance to Penn State  
>where I attended later.

The author of the Carl & Jerry series was from Indianapolis. Parvoo U. was a thin disguise for Purdue University in West Lafayette, Indiana. Although I myself did not matriculate at Purdue, I had many friends who did. All of my Purdue friends were EE majors, and found C&J to be especially amusing.

In response to a few of the SWL cards I sent in which I identified myself as WPE7BDK, I would receive a sanctimonious admonition that such a callsign, falling into a prefix group assigned to the USA but not having been issued by the FCC, was fraudulent and illegal. The hams who thus denounced me in particular, and the WPE program in general, evidently did not stop to think that, because I did not use the "callsign" to identify any radio transmissions, my activities did not even fall within the FCC's jurisdiction.

I thought the WPE program to be harmless fun, and still do.  
(I still have my certificate, dated 5-5-62 and bearing the facsimile signature of Julian M. Seinkiewicz, WPE2FY.)

--

73 de Bob, K0KR

From boatanchors@theporch.com Thu Mar 2 22:14:54 1995  
Date: Thu, 2 Mar 1995 19:05:37 -0600  
Message-Id: <9503021304.ZM11002@bugs>  
From: mark\_gaidos@MENTORG.COM (Mark Gaidos)  
Subject: RE: Drake Finals

I wanted to say thanks to all of you who responded to my original post about 6JB6's and I also wanted to say that the ensuing discussion on matching has been interesting. I called several tube vendors and Electron Tube Enterprises has them in stock. Their definition of matching was:

- a) Same manufacturer
- b) Same production run
- c) Transconductance match to within 2%.

Price was \$20 per tube including shipping. There was a time when I would have scraped around town in all the dingy surplus places, looking for something cheaper. Today, I think I'll just go for it.

- Mark

From boatanchors@theporch.com Thu Mar 2 21:04:26 1995  
 Date: Thu, 2 Mar 1995 18:22:35 -0600  
 Message-Id: <9503021756.AA22092@apollo.eeel.nist.gov>  
 From: owen@apollo.eeel.nist.gov (James C. Owen)  
 Subject: Drake mic plug

The drake mic plug is an odd size 3/16 inch I think. I would always have a 1/4 inch plug but not the smaller one and of course you know which was installed on the microphone. Therefore I standardized, a good thing to do for one who works for the National Bureau of Standards --oops NIST, I installed 1/4 inch jacks on everything the Drake C line, the Heathkit SB100 and HW12A and others I no longer have. Therefore just replace all Drake mic Jacks with a 1/4 incher. IE haven't replaced the one on the DX100B yet.

OH yes!! High Roy didn't know you were on boatanchors. Don't forget the club meeting on tuesday, haven't seen you there for awhile.

73 Jim K4CGY

From boatanchors@theporch.com Fri Mar 3 02:35:16 1995  
 Date: Thu, 2 Mar 1995 23:50:17 -0600  
 Message-Id: <9503021655.AA07609@cen.com>  
 From: gc@fox.gsfc.nasa.gov (Gary Chatters)  
 Subject: Re: Drake mic plug

>  
 > There was some postings awhile back regarding the size of the mic plug on the  
 > Drake T-4X. I am now in need of such a plug and am confused by the correct  
 > size. The manual says use a Switchcraft S-260 .210" dia. 3 conductor phone  
 > plug. The Switchcraft book says the S-260 plug mates with standard 1/4" phone  
 > jack. This seems to imply that the mic jack on the Drake is a standard 1/4"  
 > type, right? I guess I need a little clarification.  
 >

This question does seem to come up occasionally. I don't have my

T-4XB here at the office but I seem to recall that it does require the smaller plug.

There might be some confusion about the type numbers. Looking in an old (May/June 1993) Digi-Key catalog that I happen to have on the shelf here, it lists:

Switchcraft part no. 260, 1/4" three-conductor phone plug  
and  
Switchcraft part no. S260, .206" three-conductor phone plug.

An Allied catalog list both the 260 and the S260 in a table of 1/4" plugs with no difference except price. A Newark catalog doesn't have the S260 but lists an S250 and S280 and says they are .206" diameter (two conductor rather than three).

By a vote of two (Digi-Key, Newark) to one (Allied), I'd say that the "S" prefixed plugs are probably all .206" diameter.

We probably should give a little more weight to the Switchcraft catalog though.

Any other comments?

73,

Gary

From boatanchors@theporch.com Thu Mar 2 23:04:30 1995  
Date: Thu, 2 Mar 1995 09:55:49 -0600  
Message-Id: <9502027941.AA794160002@CCGATE.HAC.COM>  
From: jcreid@ccgate.hac.com  
Subject: Drake phone plug resolved

After doing a little more research (and paying more attention), I noticed that there is a Switchcraft 260 plug and an S-260 plug. The S-260 plug is labeled "for commercial use" and has a diameter of .206". The 260 (with no S prefix) is the good old 1/4" stereo phone plug. The correct plug I need is on its way from DigiKey. I'm probably gonna get doused with mail, but maybe I can nip some of it in the bud. Thanks.

-Jim

From boatanchors@theporch.com Thu Mar 2 23:49:18 1995  
Date: Thu, 2 Mar 1995 09:53:41 -0600  
Message-Id: <MAILQUEUE-101.950302095534.448@ics.uwex.edu>  
From: "Denny Gilbertson" <GILBERTSON@ics.uwex.edu>

Subject: Drake tube matching

Does anyone have a good circuit modification for the Drake T4XB that will permit using unmatched tubes. I've found the information on the topic very interesting to date. What's the best way to deal with this problem? Thanks

Denny Gilbertson  
K9JCZ

From boatanchors@theporch.com Fri Mar 3 02:47:07 1995  
Date: Thu, 2 Mar 1995 23:51:51 -0600  
Message-Id: <199503021723.LAA19972@quake.xnet.com>  
From: mshaum@xnet.com (Mark Shaum)  
Subject: Re: Drake tube matching

>Does anyone have a good circuit modification for the Drake T4XB that  
>will permit using unmatched tubes. I've found the information on the  
>topic very interesting to date. What's the best way to deal with  
>this problem? Thanks

Back around '68-'69 I modified my buddy's T4XB with individual bias adjust pots for each final. Separate voltage dividers with an adjust pot for each tube, fed by the main negative bias supply. I don't recall if I had to use diodes to manage the standby/idle voltage switching from the relay or not, probably not. As a one-year-as-a-general ham I wasn't all that versed in design techniques.

Why did I do this? Couple reasons, even though sweep tubes were generally cheap at the time, they weren't cheap to 13 and 14 year olds (which the two of us were!). Besides, I had the pots and resistors. What we had noticed was that one tube ran 'hotter' than another (brighter dull red?) under full power conditions. We used the pots to adjust the bias voltages so that each tube would pull exactly one half of the desired idle current.

In retrospect, the above might help a little, but if tubes are grossly mismatched, matching idle currents doesn't really mean that they are carrying an equal load at full RF power. It may be impossible to match two parallel tubes if they aren't from the same manufacturer, for example, especially in RF designs. There is a little more leeway if you are working with audio circuits.

Case in point of recent note. My first purchase (few years ago) of 'cheep' China-made 811A bottles showed visible differences in physical structure (like tube height!) as well as electrical characteristics. One tube actually drew 25% more filament current at rated voltage than the rest! Running these in parallel with individual bias adjustments, as well as adjustable cathode feedback from the center tap of separate filament

transformers, etc made me give up on that idea. They now serve fine (one at a time) as table decorations, regulator tubes in HV DC supplies, and foot warmers. And these were simple triodes. I'd hate to have to work with some of the 'early' imported 6146's!

73! - Mark, NE9G

From boatanchors@theporch.com Fri Mar 3 03:12:49 1995  
Date: Fri, 3 Mar 1995 01:19:50 -0600  
Message-Id: <Pine.3.89.9503030105.A25176-01000000@ozarks>  
From: "C. Frank Gilmore" <fgilmore@ozarks.sgcl.lib.mo.us>  
Subject: Re: Drake tube matching

On Thu, 2 Mar 1995, Denny Gilbertson wrote:

> Does anyone have a good circuit modification for the Drake T4XB that  
> will permit using unmatched tubes. I've found the information on the  
> topic very interesting to date. What's the best way to deal with  
> this problem? Thanks  
>  
> Denny Gilbertson  
> K9JCZ  
>

Denny when I have unmatched tubes...which is most often the case now....  
I just neutralize as carefully as possible and reduce power by about 30  
watts or so....and let her run. That is about all you can do.

73, de Frank K0JPJ ex-W5PVX ...-.-

PS: I bought what was supposedly the last matched pair of GE 6JB6s over a  
year ago from R-F parts....the boxes looked like they had been through a  
hail storm. The tubes were far from matched. The previous pair they had  
sent me were dead on arrival.

A pair of cheap (?) Universals which Drake folk say to run from turned  
out to be closely matched but brand new the best RF out on 10 was 26 watts,  
up to nearly 100 on 15, and normal on lower frequencies. Am still  
running them in one of the Drake lines here.

From boatanchors@theporch.com Thu Mar 2 21:50:07 1995  
Date: Thu, 2 Mar 1995 18:31:56 -0600  
Message-Id: <950302173901\_71407.1774\_FHV76-1@CompuServe.COM>  
From: "Joseph J. Curry" <71407.1774@compuserve.com>  
Subject: Re: Error Condition Re: Subscription

Thanks for the input. I am stilling getting accustomed to the INTERNET command structure.

Have sent message to listproc@theporch.com.

JJC

From boatanchors@theporch.com Thu Mar 2 23:07:39 1995  
Date: Thu, 2 Mar 1995 21:16:59 -0600  
Message-Id: <Pine.3.89.9503021937.A11953-01000000@mm1001.theporch.com>  
From: Kevin J Pease <kevin@mm1001.theporch.com>  
Subject: HP 727 Manual

Has any one got a manual for a TS-413 C/U signal generator. I beleive it is a model Hewelete Packard model HP 727 generator. I have one that needs some repair. The audio oscilator is not working The output meter also does not zero properl. If all I can get is a schematic that would be verry helpfull.

Kevin J Pease  
WB0JZG Mt Juliet, TN.  
mm1001.theporch.com

From boatanchors@theporch.com Thu Mar 2 21:01:30 1995  
Date: Thu, 2 Mar 1995 10:35:21 -0600  
Message-Id: <Pine.3.89.9503020847.C31147-01000000@mm1001.theporch.com>  
From: Kevin J Pease <kevin@mm1001.theporch.com>  
Subject: Re: HRO-60 Help

Could it be that during the re-caping and re-resistoring a wrong part value was inadertently installed ?

Kevin J Pease  
WB0JZG Mt Juliet, TN.  
mm1001.theporch.com

From boatanchors@theporch.com Thu Mar 2 21:05:05 1995  
Date: Thu, 2 Mar 1995 18:18:31 -0600  
Message-Id: <9503022118.AA10615@internet1.lotus.com>  
From: Richard DuFosse <Richard\_DuFosse.LOTUS@crd.lotus.com>  
Subject: HT-44 Question

Anyone out there have experience with the Hallicrafters HT-44. Mine loads up on 80-20 just fine. However, when I peak the driver on 15 the peak is extremely sharp, so sharp in fact that just removing my hand from the knob detunes it. Getting it tuned up is a real adventure. Do these rigs have a reputation for being touchy on the higher bands, or does it sound as if mine has a problem?

Also, have been following the thread on the WPE calls. This sounds vaguely familiar to me from back when I was WB2LGQ in the '60's, and in fact I seem to remember having had one of these, but I can't for the life of me remember what they were. Can someone refresh a tired memory?

Regards,  
Richard, AA1EF

From boatanchors@theporch.com Thu Mar 2 21:07:31 1995  
Date: Thu, 2 Mar 1995 18:14:17 -0600  
Message-Id: <9503021627.AA13908@csrvcs1.triad.com>  
From: bwb%csrvcs1.triad.com%triada.triad.com@triada.triad.com (Bruce Bacon)  
Subject: Keepin' em warm

Greetings all,

A couple of questions to pose for the group:

I've recently acquired a very nice HP variac with both current and voltage meters. Knowing that it's healthier for a boatanchor to stay lit up, would there be any harm in leaving my HQ180 (not an "A") and R390A powered up at, say 60 volts when not in use? Then, when it's listening time, bring the voltage up to 115? The receivers would be used almost every night.

I also got a KRS DD2 LED frequency display for the HQ180. I'd be interested in knowing how (and where) to install this unit to monitor the VFO frequency. Any buffering needed? It did not come with instructions. If anyone has or is using this display with their '180, I'd be very interested in any comments you might have. Thanks and

73,

-Bruce Bacon WPE6DIQ/KE6GLS (bwb@triad.com) Livermore, CA



From boatanchors@theporch.com Thu Mar 2 10:10:45 1995  
Date: Thu, 2 Mar 1995 07:50:26 -0600  
Message-Id: <950302085346\_36919327@aol.com>  
From: JosephWP@aol.com  
Subject: Manual f/Clegg Apollo 700

I need a manual for a Clegg Apollo 700 which I acquired recently.

Help!

Joseph Pinner +  
Lafayette, LA  
KC5IJD

From boatanchors@theporch.com Thu Mar 2 22:11:15 1995  
Date: Thu, 2 Mar 1995 10:23:49 -0600  
Message-Id: <199503021627.IAA15478@netcom16.netcom.com>  
From: dgf@netcom.com (David Feldman)  
Subject: Re: Matched Finals

>73 de dan -- WPE0DEN...'er ..uhmmm WA0JRD rites:  
>>Good question,Jack! I would like to know what makes a pair of tubes "matched"  
>>and what if any problems/caveats occur using a random 2 or 3 of the same  
>>tubes in the final.....anyone?  
>  
>Now as to matching it yourself, that would require first knowing what the  
>criteria were for matching (specs must have been published somewhere,  
>most likely in a contemporary design manual), acquiring a number of tubes,

Last year I picked up three Dentron GLA-1000 series amplifiers (four 6LQ6 sweep tubes in parallel, grounded grid). After fixing their original problems (each had one dead power supply diode, causing blown fuses), I tested each of the 12 tubes along with some other tubes on-hand. I tested the tubes by installing only one of the tubes in one of the amplifiers, driving the amplifier with 25W, and measuring max output on 20M. Each tube had a particular output.

For each of the 3 amplifiers, one of the four tubes was appreciably weaker than the others, and one of the four was a "hero" and was stronger than the others. One amplifier's "weak" tube actually had zero output (even tho it's filament would light).

From boatanchors@theporch.com Thu Mar 2 23:26:00 1995  
Date: Thu, 2 Mar 1995 09:57:53 -0600

Message-Id: <9503021454.AA19822@uvs1.orl.mmc.com>

From: padgett@tccslr.dnet.mmc.com (A. Padgett Peterson, P.E. Information Security)

Subject: Matched Finals

73 de dan -- WPE0DEN...'er ..uhmmm WAOJRD rites:

>Good question,Jack! I would like to know what makes a pair of tubes "matched"  
>and what if any problems/caveats occur using a random 2 or 3 of the same  
>tubes in the final.....anyone?

Well if I were to make a guess, it would be a worker sitting at a a curve tracer with some lines drawn on it (say A, B, C, & D) and a bin of tubes. Plug in a tube and if the portion of the curve of interest is entirely inside a pair of lines it goes into the appropriate bin - A, B, C, or D. If the curve crossed any line it went into the "unmatched" bin and anything totally outside would go into the "reject" bin.

When someone requested a "matched" pair, they would just take two out of one of the "matched" bins. Might even have a "premium grade" matched pair that was only "A"s, at least that is how I would do it on an assembly line.

Now as to matching it yourself, that would require first knowing what the criteria were for matching (specs must have been published somewhere, most likely in a contemporary design manual), acquiring a number of tubes, and then doing the same thing (might have to breadboard together a fixture).

Shouldn't be very difficult.

As to putting together unmatched tubes, well one effect might be as mentioned, the higher gain tube could do most of the work however even stranger things could happen if the tubes were non-linear and the curves crossed at some point - might work well at say 70% drive but go all wonky at 90%, just depends on the circuit. Bet the filament power specs would be pretty rigid too.

Of course you realize that I haven't a clue what I am talking about 8\*).

Warmly,  
Padgett

From boatanchors@theporch.com Thu Mar 2 23:14:12 1995

Date: Thu, 2 Mar 1995 18:48:33 -0600

Message-Id: <n1417968662.45832@msmailgw1.arlut.utexas.edu>

From: "rohre" <rohre@msmailgw1.arlut.utexas.edu>

Subject: Matched Finals educated conjecture

Not having seen an immediate response, I will throw in what I \*know\*, and what I think you should get if you buy matched finals.

As someone alluded to, matched finals ideally should mean the nth and nth+1 tube to come down a production line at some particular time. If there were no change of materials, (even batches of the raw materials, procedures, etc.,etc), we could expect these tubes to be alike as two peas in a pod. In fact this rarely happens, and might not be any better than the real way tubes are conditioned or matched.

Now, consider what the tubes must do: If in a parallel arrangement, you want to develop full power from equal power contributions from each tube in parallel. In other words, you want the finals to divide the work *\*equally\**. This means under the conditions of loading, (and this is true of push pull as well), that each tube will emit the same amount of electrons and deliver them to the plate, thus making a balanced or equally shared arrangement. Now the geometry of the tubes should be near identical, and variations in assembly so minute, that the overriding consideration is: will each tube pass the same amount of plate current from the filamentary emissions? Because the oxides of filaments age, and may vary from batch to batch, only if the two tubes start out life together will emission be near the same. To avoid random jumps or unequal performance, new tubes are placed in row upon row of test sockets and "burned in" until the currents are equal for certain tubes. These then "match". After the infant mortalities are weeded out and all characteristics stabilize, then you can pair up, or group, any number of tubes needed to make matched sets. Thus an emission test, or equal plate current for the same bias condition, determines the match.

If you want to do this at home, just put in two (or more) tubes of near same date codes, (if known), and turn on the filaments and let 'em cook until they have the same emission tests in a tube tester. That should pretty well match them, and I would bet better than some on the market today of dubious origin.

The proof of the pudding as always, is do they work *\*normally\** in the final application. Say a rig of paralleled final tubes. Does one tube get hotter than the others? Does one plate get more red than the others, if of the graphite type? You actually in an extreme case would see the effects of mismatch. At worst, one tube taking the most work (power) would fail before the others. The others might be the *\*bad\** ones because they did not *\*do their share\** from the beginning.

Now for matching to do you any good, the other necessary procedures for your particular finals must be done, like neutralization, etc. Make sure the parasitic chokes are in good order, or updated, as some amplifier designs had poorly designed parasitic suppressors from the beginning, and back issues of QST or Ham Radio abound with updates to popular amplifiers. Consult the annual indexes, and ask around to find out if certain models were known to need modification to have long tube life, or clean operation. If you don't have a spectrum analyzer, then a set of wavemeters could be used to check for spurious outputs from an amplifier, or a well shielded wide coverage receiver, with a sniffer probe, (loop coil on end of coax cable on a WELL insulated stick, one

that will keep you from contacting the plate voltage, if you blunder and touch the hot stuff). Have a CPR trained helper, if you are working on high voltage finals. Someone to be an extra set of eyes, and a source of first aid, if needed.

Any questions? Remember, safety first. Don't adjust things inside the high voltage finals area with the power ON. Make a small change in a certain direction, after things are discharged; then repower up and check for the effect of the change. There was another excellent post on neutralization re Drakes, and this should be generally true. The whole result should be to have the power peak at the plate current dip, when properly loaded into 50 ohms.

From boatanchors@theporch.com Fri Mar 3 00:02:18 1995  
Date: Thu, 2 Mar 1995 09:44:06 -0600  
Message-Id: <Pine.ULT.3.91.950302100911.29245B-1000000@dua150.kpt.emn.com>  
From: "Barry L. Ornitz" <ornitz@EMNGW1.emn.com>  
Subject: Re: Matched finals? (More on matching tubes)

On Wed, 1 Mar 1995 rdkeys@csemail.cropsci.ncsu.edu wrote:

> I wonder if anyone has remembered an ANCIENT 1930's firebottle trick in  
> balancing paralleled toobos via the use of maybe 10-100 ohms serialized  
> into each paralleled grid?  
> Bob/NA4G

In the 1930's when almost all finals were running Class-C and grid current was produced by the drive, this may have helped. In the more modern SSB rigs with AB1 finals, series resistors in each grid lead are there not for balancing but for parasitic suppression. Ferrite beads are sometimes used instead. [Hollow-state purists: Stop Reading Now!] With modern power MOSFETS this same trick is common when paralleling devices. Without the degeneration provided by the gate resistors, the MOSFETS can often go into a wild high frequency oscillation mode which quickly destroys them. Fortunately, vacuum tubes are a little more forgiving.

On matching tubes, the criteria I personally used was matching the mutual transconductance to within 3 to 5%. This is a little better than matching for equal idling current. I never seemed to have any trouble in the many times I used tubes I matched myself. In private communication yesterday, I mentioned the time I ordered about 50 tubes as a club purchase. The RCA tubes arrived apparently from two production lots as determined by the date codes. There was considerable spread in the transconductances but I got 5 matched trios and 16 matched pairs from the lot of 50. The trick here is to have a large number of tubes to start with.

As for other technicalities on matching tubes, Doug DeMaw's articles in QST on sweep tube linears gives other details, and Bill Orr's articles in Ham Radio tell more about "full blast" operation of sweep tubes.

Finally, the person who noted that neutralization by coincidence of plate current dip with maximum power output was correct that the tubes have to be well matched for this to work.

Parallel tubes are a real pain in the left cheek if balancing circuitry is not used. The trick someone else mentioned about filament voltage is actually more applicable to 4-400 or 3-500 pair linears. With separate filament transformers and rheostats, you can adjust each tubes voltage so the idling currents match or so the cathode currents under drive match. Separate ammeters as DeMaw suggests come in handy here.

73, Barry WA4VZQ      ornitz@emn.com

From boatanchors@theporch.com Thu Mar 2 23:27:15 1995

Date: Thu, 2 Mar 1995 21:34:31 -0600

Message-Id: <9503030311.AA23367@uvs1.orl.mmc.com>

From: padgett@tccslr.dnet.mmc.com (A. Padgett Peterson, P.E. Information Security)

Subject: Matching Tubes (Factory Style)

(thought I sent this about 14 hours ago but this sent since appeared but not this so must be in never-never land somewhere).

In a factory, the common method for component matching went something like this:

A semi-trained (we tried to make things as foolproof as possible so not much was required) worker would have at his/her station a hopper filler with whatevers on the left (we always went left to right when possible) a curve tracer possibly attached to a special circuit in front, and five or six slots/baskets on the right. Typically these would be marked "A", "B", "C", "unmatched", and "reject" (the last was usually much smaller).

On the circuit tester screen there would be drawn four non-intersecting lines - between the first and the second the letter "A" and so on. (For those who wondered why curve tracers were so expensive and who would buy them, this is why - takes little or no skill to operate once set up).

The item (say a tube) to be tested would be placed in the fixture and after an appropriate interval would engage and paint a trace on the scope. If it was wholly inside the "A" area it would go in the "A" bin and so on. If the curve did not stay within a category but crossed into two or more, it would go into "unmatched". Other criteria would result in "reject" or sometimes a different grade.

In the most extreme case where there was one line and a heavy demand for matched sets, an "unmatched" unit would be almost guaranteed to be a bit strange.

If there was a special need, a matched set of "A"s might carry a premium over "B"s since these were typically the highest gain/performance but any two "A"s or two "B"s or two "C"s would be considered matched. The most grades I ever saw was five and two were common, just depended on the specifications.

Usually just what the matching criteria were would be published in a spec sheet or a design manual but in a factory environment, usually "matched" did not mean specifically to each other, just that both would fall inside a common range.

>From experience, I would be surprised if of five equal items, at least two and probably four could not be "matched" to a pair however one pair might be considerably different from the other, just that each is similar to its mate.

Certainly, you would not take just one and then try to find its perfect.

As mentioned, there are ways (filament voltage, grid resistance) to artificially match two dissimilar items but usually this means that the best is degraded to match the poorest. Not necessarily bad but rarely desirable.

Just some musings from my days at GM where I designed assembly lines, really I haven't a clue how RCA matched tubes but would not be surprised if it were similar to the above.

Warmly,  
Padgett

From boatanchors@theporch.com Thu Mar 2 21:34:55 1995  
Date: Thu, 2 Mar 1995 10:27:35 -0600  
Message-Id: <Pine.3.89.9503021009.A18004-01000000@ozarks>  
From: "C. Frank Gilmore" <fgilmore@ozarks.sgcl.lib.mo.us>  
Subject: Re: Military BA Films

On Thu, 2 Mar 1995, Jeffrey Herman wrote:

> Hi Dick,  
> The PBS weekly series VICTORY AT SEA shows a lot of radio room  
> shots aboard ships (WWII). You might contact your PBS station  
> to find out who produces that program.  
>  
> 73 from Hawaii,  
> Jeff NH6IL

>

Complete sets of "Victory at Sea" are available from a number of sources at rather reasonable prices. Publisher's Central was showing them in their catalog last summer. Think they ran about \$70 or 80 a set. I am off their mailing list apparently for lack of purchases so can't check it out....will look around. There are many other similar series such as "Air Power" "World War Two" "The Valient Years" etc that are loaded with brief clips of communications gear.

73, Frank K0JPJ ex-W5PVX ...-.-

From boatanchors@theporch.com Thu Mar 2 22:09:03 1995  
Date: Thu, 2 Mar 1995 20:00:07 -0600  
Message-Id: <9503022142.AA01062@speckle.ncsl.nist.gov>  
From: morgan@speckle.ncsl.nist.gov (Roy Morgan)  
Subject: Re: Military BA Films

>Does anyone else share my interest in finding these films? Does anyone  
>have any idea where they might be found?

According to a person at the Naval Historical Library (202-433-4131):

"All Navy films and videos up to 1967 are held at the National Archives."

National Archives  
Motion picture and Video Archives Section  
(Archives II in Maryland)  
301-713-7060  
301-713-6790 Research Room

Their e-mail address is: mopix.nar.gov  
The Fax on Demand number is 301-713-6905.

The Naval Imaging Command is at the Anacostia Naval Air Station in DC (202-422-4475). They maintain the Navy's archive of photographs, and may have films also, but current films and videos are at Norfolk at the Naval Training Command.

The Navy and Marine Corps Museum is at the Washington Navy Yard. The Navy Historical Library is there also (phone above).

--  
Roy --

Roy Morgan / Tech A-266 / NIST / Gaithersburg MD 20899

(National Institute of Standards and Technology, formerly NBS)  
301-975-3254 Fax: 301-948-6213 Internet: morgan@speckle.ncsl.nist.gov  
---

From boatanchors@theporch.com Thu Mar 2 22:27:00 1995  
Date: Thu, 2 Mar 1995 20:39:23 -0600  
Message-Id: <199503022102.0AA17091@Freenet.HSC.Colorado.EDU>  
From: al511@freenet.hsc.colorado.edu (Robert Neece)  
Subject: Re: Military BA Films

Jeff Herman writes:

>The PBS weekly series VICTORY AT SEA shows a lot of radio room  
>shots aboard ships (WWII). You might contact your PBS station  
>to find out who produces that program.

Several of the video-rental stores in my neck of the woods  
stock the entire Victory at Sea series. Each tape rents for  
a buck.

--

73 de Bob, K0KR

From boatanchors@theporch.com Thu Mar 2 22:52:18 1995  
Date: Thu, 2 Mar 1995 10:19:55 -0600  
Message-Id: <Pine.3.89.9503021024.A18004-0100000@ozarks>  
From: "C. Frank Gilmore" <fgilmore@ozarks.sgcl.lib.mo.us>  
Subject: Re: Military BA Films

On Thu, 2 Mar 1995, Dick Dillman wrote:

>  
> The WWII military aviation enthusiasts among us know that the training  
> films for several aircraft types of that era - B-17, P-51, B-26, P-47, etc.  
> - are now available on video tape. For a long time I've wondered: where  
> are the equivalent tapes for the BC-610, TBL, BC-342, BC-611 and the like?  
> Certainly they must have been made, but do any still exist? To my  
> knowledge only one such tape has been made available, that for the SSTR-1  
> suitcase "spy" set, and it is of poor quality.  
>  
> Then there are the newsreel and documentary films of the era showing  
> operations in radio rooms aboard ships and ashore, in monitoring stations  
> and at command posts. Producers seem to be able to find this footage, as



> they did for the NOVA program "The Codebreakers" which shows all too short  
> clips of intercept operators as Super-Pros and BC-324s. Clearly, this  
> footage still exists in archives somewhere.  
>

Dick another of my hobbies is collecting and running an archive of recorded sound and video....nearly a quarter million items in it now. Because of work and some health problems in recent years have slowed down some and am way behind on cataloging it.

I have a lot of training material but absolutely nothing pertaining to communications equipment. If it was made I have never run across it and I used to travel nationwide to yearly conventions of collectors and this was something always on my "want" list!

There are rumored to be some excellent 16mm film made in Britain during the war but I haven't seen or been able to run down a source.

Recently was watching some docu. on Discovery while I was down with flu and had extensive shots of British monitoring stations loaded with AR-88s. Think I was recording at the time so will run across it when I edit. Lord knows when that will be. As my fellow collectors say when they view the thousands of T-120 tapes already recorded but unedited...."not in this lifetime!" Hi!

A classic scene that probably impressed me more than anything was in "Dr. No" when they had a brief shot of a massive intercept room with racks of RA-17s. I have heard two reliable sources with two stories on where that scene was shot. One swears it was in one of the BBC monitoring stations, and the other swears it was in Naval Command HQ. Both are british hams, both in the media field, and maybe both are wrong. I know that is what finalized my decision to acquire my first RA-17!

I have some a small collection of German propaganda films that were transfered to video tape using some rather crude process in the early days of VT. Then copied to VHS by a friend. They show some interesting shots of German comm. centers. Somewhere I have one brief clip that shows some of the Japanese "copies" of HROs being used. (Owned one of those once....fellow that traded it in at my store had liberated it and was an idiot and I was a bigger fool for swappeing it off later!

73, de Frank K0JPJ ex-W5PVX ...--

From boatanchors@theporch.com Fri Mar 3 02:36:23 1995  
Date: Thu, 2 Mar 1995 23:53:06 -0600  
Message-Id: <Chameleon.4.01.2.950302165420.jproc@>  
From: jproc@worldlinux.com

Subject: RE: Military BA Films

Dick,

There is a VHS video that I highly recommend. It is titled "If Only She Could Talk" and features HMCS Haida, a World War 2 Tribal Class destroyer. It focuses on the battle honours of this great ship and there are a few WW2 clips of radio room operation. One passage, which shows how the main radio office looks today is narrated by one of Haida's former telegraphists. The video costs \$14.95 (Canadian funds) and is available from Haida's gift shop. It can be ordered through:

Carla Morse  
HMCS Haida Naval Museum  
c/o Ontario Place  
955 Lakeshore Blvd W.,  
Toronto Ont.  
M6K 3B9  
Canada

Regards,

-----  
Jerry Proc, VE3FAB  
Radio Restoration Volunteer  
HMCS Haida  
E-mail: jproc@worldlinx.com  
Toronto, Ontario  
-----

From boatanchors@theporch.com Thu Mar 2 11:41:43 1995  
Date: Thu, 2 Mar 1995 08:40:33 -0600  
Message-Id: <9503021508.AA104126@csemail.cropsci.ncsu.edu>  
From: rdkeys@csemail  
Subject: Re: Multi-element vs triode tubes

>  
> OK, ladies and gentlemen, back into the theory for a bit....  
>  
> A tube with three elements (a triode) conducts from cathode to plate,  
> with the conduction controlled by the voltage level present on the grid.  
> OK? OK.  
>  
> Well, then, why multigrid tubes? Wouldn't it be possible to do it all by  
> just tying the various bias voltages anbd such onto 1 grid, perhaps with  
> capacitive coupling?

Efficiency would be rather poor.

>  
> Bit-rotted minds want to know..... -ajr N1TWY, ex-WA1YHY  
>

As I understand the history/theory of it, there are three main reasons for using multiple grids in tubes.

1. Increased gain (transconductance) over what a triode will provide.

I think this is a function of grid geometry mainly. The grid takes up electron stream space, so if there is only one, the control grid, it only has a certain maximum control efficiency. Add a screen grid to help shape and guide the electron beam by acting like a sort of in-between plate. It helps to accelerate and shape the electron beam. But, since the screen grid is ``full of holes'' essentially all of the electron beam passes through the screen grid and on to the plate. Additional elements, particularly beam forming plates, further help to guide and shape the electron beam. Suppressor grids help to reduce back emission (secondary emission) from the plate. The net effect is a gargantuan increase in sensitivity or power in tetrodes or pentodes as compared with triodes.

2. Increased isolation from grid to plate circuits over what a triode will provide.

Typically, a triode has some 2-10 times more grid-plate capacity than does a tetrode or pentode. Hence, the triode is very poor at isolating plate and grid circuits. That is great for typical oscillators, but lousy for amplifiers and hence triodes usually require neutralization (balancing out of grid-plate coupling capacitance) to work effectively. Tetrodes and pentodes generally do not require such neutralization to work properly, although most modern rigs using highly stressed pentodes or beam power tubes such as 6146's/6JB6's often have a small bit of neutralization capacitance added to the design (often a strip of aluminum just sitting out somewhere near the tube envelope on a ceramic pillar. Screen grids and to a lesser extent suppressor grids are usually thought of here for increasing grid-plate isolation.

3. To provide additional tube inputs for coupling, bypassing, etc.

Triodes can make good mixers, but in the early days, the use of additional grids for things like pentagrid converters (mixers) in superhets made signal injection/mixing/control relatively cheap and easy, while maintaining things like good isolation between heterodyne oscillators and the converter/mixer function. In the earliest superhets, triodes were used throughout, but there was significant

interaction between mixer and heterodyne oscillator. The additional grids helped to isolate the functions in separate tubes, and reduce interaction. But, when all the elements were combined into one tube, the same thing was accomplished all in one envelope.

Historically, increased gain was the initial reason for having multiple grids (back in the early 1920's). In the late 1920's and early 1930's diversity in function for isolation purposes (e.g., Dow's electron coupled oscillator design and RCA's tetrode/pentode oscillator designs) began to be of value. At the same time, the multigrid mixers began to come upon the scene.

There are additional nuances such as higher plate impedances in tetrodes and pentodes as compared with triodes, but that does not seem to have been practically important historically in the development of multigrid tubes. It seems to have been more a side effect rather than a design goal.

I am sure others can give more theoretically optimum accounting than this, but that is all I can do off the top of my head without the first cup of mud early in the morning..... (:+{>....

Yawn.....

73/Bob/NA4G

From boatanchors@theporch.com Thu Mar 2 11:40:23 1995  
Date: Thu, 2 Mar 1995 08:55:18 -0600  
Message-Id: <199503021459.JAA16609@espresso.eng.umd.edu>  
From: Philip Gwynne McCoy <dgnova@glue.umd.edu>  
Subject: multigrid tubes

>From: Alan Richer <Alan\_Richer.LOTUS@crd.lotus.com>  
>Subject: All right, explain me this.....

>OK, guys, back into the theory for a bit....

>A tube with three elements (a triode) conducts from cathode to plate, with the  
>conduction  
>controlled by the voltage level present on the grid. OK? OK.

>Well, then, why multigrid tubes? Wouldn't it be possible to do it all by just  
>tying the various  
>bias voltages anbd such onto 1 grid, perhaps with capacitive coupling?

>Bit-rotted minds want to know..... -ajr N1TWY, ex-WA1YHY

Triodes have capacity between the grid and plate, thus in radio frequency amplifiers, energy is fed back from the plate or output to the input. This feed back causes regeneration or degeneration, depending upon the plate load impedance. This affects the input circuit selectivity. If there is enough feedback, oscillation will occur.

The pentode has less grid plate capacity, thus eliminating or greatly reducing this effect

From boatanchors@theporch.com Fri Mar 3 02:32:00 1995  
Date: Thu, 2 Mar 1995 23:52:26 -0600  
Message-Id: <F2730819BE@s1.xetron.com>  
From: "Tom Alverson" <TOMA@s1.xetron.com>  
Subject: Need Mike connector for EV-630

I have an old EV Mike (I think it is an EV-630) that has the standard 3 pin "pa" type of mike connector (not XLR, this has a threaded collar). This is similar to but the opposite sex to the connector on the D-104 mike (I can plug the 2 mikes together). Does anyone know of a source for these connectors?

Tom NU8D

From boatanchors@theporch.com Thu Mar 2 23:11:07 1995  
Date: Thu, 2 Mar 1995 18:53:10 -0600  
Message-Id: <9503021904.AA27002@ausable.crd.Ge.Com>  
From: mallick@ausable.crd.ge.com (John Mallick)  
Subject: Re: R-4A problems

Maybe a flakey connection at the MUTE connector? There is usually a shorted plug in there, or a connection to the T4X T/R relay. Maybe the relay contacts are flakey?

Isn't C61 the one for the crystal calibrator...I can't remember...

73, John WA1HNL

From boatanchors@theporch.com Fri Mar 3 00:09:04 1995  
Date: Thu, 2 Mar 1995 10:14:25 -0600  
Message-Id: <9502027941.AA794161143@CCGATE.HAC.COM>  
From: jcreid@CCGATE.HAC.COM  
Subject: R-4A problems

Hi gang,

I know there are many Drake fanatics out there and I need to call on a few of you for some help. My recently acquired R-4A seems to have an intermittent receive problem. Sometimes when I turn it on, the S meter hovers around +60dB and I get no signals whatsoever. Even in CAL mode there's nothing. Shut it

off, throw a temper tantrum or two, power it back up and presto! It's working again although even with the antenna disconnected the S meter shows S5. I'm wondering if maybe the local oscillator is flakey and maybe not starting up every time. I'm also open for suggestions on what type of contact cleaner to use on the wafer switches. Both the receiver and transmitter have been sitting idle for many years. Additionally, why would the previous user have a small screwdriver almost permanently installed over C61 in the receiver? I'm sure there'll be more questions as I approach the transmitter. I'm already battling with a flakey Jones plug. Thanks for any help.

-Jim

From boatanchors@theporch.com Fri Mar 3 00:51:05 1995  
Date: Thu, 2 Mar 1995 23:00:36 -0600  
Message-Id: <9503021931.AA26098@ig1.att.att.com>  
From: knudsen@ihades.att.com  
Subject: re: R390 as band cruiser

I have to agree. I own a 390A and really enjoyed it until the front end died -- one of many projects to get to. But for cruising thru the bands -- SW broadcast, ham, or funny communications -- it isn't as much fun as some other receivers could be. Reasons:

- knob hard & slow to turn (Really should add a spinner handle)
- gotta flip the MC Change bandswitch every 1000 KC
- rolling digits just don't give that nice visual feeling of crossing the band
- to change to another band several MCs away, you gotta crank and crank that bandswitch. And I've been warned not to add a spinner to it, else I'll strip the Swiss Army gearbox inside.

It's a great rcvr and we all know why, but the above do affect the feel. BTW, I did carefully lube everything, including the digit counter, so it's pretty smooth.

However, the guy who sold me the 390A did offer me a 51J a couple years earlier at the same price. I might feel more like cruisin' with its wide analog dial, tho ya still gotta roll the bandswitch every 1 MC.

Only other gripe is the nasty audio ringing from the sharp-cutoff xtal filters. Maybe I should swap for a 390-non-A?

It does have the best noise limiter, adjustable, I've ever used.  
--mike knudsen W9NRD

From boatanchors@theporch.com Thu Mar 2 11:16:30 1995  
Date: Thu, 2 Mar 1995 08:36:53 -0600

Message-Id: <m0rkC32-000uGoC@twisto.eng.hou.compaq.com>  
From: Dave=Sharp%Legal%Corp=Hou@bangate.compaq.com  
Subject: re: Re: Boatanchor Files available...

Hi,

I'm not sure I can put in the time either, but I'd be interested in sifting thru it to see what is is and maybe figgure out how / what is to be organized. I have several 1-2 million page databases under my belt and ONLINE here in my office. (I have 70 GB of disk on my system - yes G's)

As you can gues I use some rather sophisticated databasing stuff but for the most part I don't need to do a LOT of organizing (nor do I have time) but I may be able to make a 10,000 ft review.

Just tell me what to "get", and I'll try it.

Dave

From boatanchors@theporch.com Thu Mar 2 21:01:50 1995  
Date: Thu, 2 Mar 1995 18:16:25 -0600  
Message-Id: <m0rkFva-000EptC@dna.metronet.com>  
From: kmccoy@dna.metronet.com (Kevin McCoy)  
Subject: Re: Somehow it works (1R5 replacement for 1L6)

On Mon, 27 Feb 1995 20:33:34, padgett@tccslr.dnet.mmc.com (A. Padgett Peterson) wrote:

>Otherwise effectively G3 and G4 have been swapped but to the plate it all  
>looks about the same. Apparently somehow it works though I suspect that the  
>sensitivity could be improved with a little redesign. All I need now  
>is a pentagrid converter design manual. Hank suggested Radiotron version 3,  
>anyone have a spare ?

I wish! I'm borrowing Radiotron 3, Terman's "Radio Engineering" (1947), and a nice little volume by W.H. Aldous, called "Thermionic Vacuum Tubes" (1952) from my university library, for the whole semester.

Radiotron 3 has about 9 pages on frequency converters, giving theory of operation, circuit examples and a little design info on 7 types:

- 1) Autodyne
- 2) Triode-pentode (6F7)
- 3) Pentagrid converter (6A8-G)
- 4) Pentagrid mixer (6L7-G) with separate oscillator
- 5) Triode-heptode (6J8-G)

- 6) Triode-hexode (6K8-G)
- 7) 6SA7 type pentagrid

Terman devotes 7 pages to mixer and converter tube type frequency converters and another 5 pages to crystal and diode type mixers. Overall, Radiotron 3 is more cookbook, while Terman is more analytical. In trying to analyze a "non-traditional" situation, Terman might be a better bet if you enjoy the mathematics.

BTW - I also would like to purchase these books if anyone would like to part with their "spares".

73,

-- Kevin

```
*** Kevin McCoy      KJ5PM   DNA Enterprises, Inc.      ***
*** (214) 424-7795    1825 E. Plano Parkway, Suite 230A ***
*** kmccoy@dna.metronet.com  Plano, TX 75074      ***
```

From boatanchors@theporch.com Fri Mar 3 00:21:53 1995  
Date: Thu, 2 Mar 1995 22:25:35 -0600  
Message-Id: <9503022215.aa16743@jackatak.theporch.com>  
From: Fire Bottle archive handler <firebotl@jackatak.theporch.com>  
Subject: Subscription problems

Gang-

> Am I still connected or has there just been no traffic today ?  
We continue to have a problem, and it is possible that you may be "disconnected" from the list for a brief time. I will do my best to reconnect everyone as soon as I am able...

Sorry, but we can NOT figure why this sudden change of heart. The List processor was working so well for a while, and now the bloody thing is cancelling about 2/3 of the subscriptions each day! YEow!

We are working on a solution... (and learning a GREAT deal more about teh internals of the list processing software than we want! ;^)

--

73

Jack, W4PPT/Mobile (75M SSB 2-letter WAS #1657/#1789 -- both all mobile! ;^)  
- - - BoatAnchor Mailing List Archiver/Owner - - -  
listown@jackatak.theporch.com - firebotl@jackatak.theporch.com



From boatanchors@theporch.com Thu Mar 2 20:58:25 1995  
Date: Thu, 2 Mar 1995 18:17:23 -0600  
Message-Id: <9503021943.AA21754@uvs1.orl.mmc.com>  
From: padgett@tccslr.dnet.mmc.com (A. Padgett Peterson, P.E. Information Security)  
Subject: Thanks for all of the answers

Thanks to quite a few people I see that encryption is in fact forbidden on the amateur bands but the big point to me is that it is a requirement that is part of being granted the license and has nothing to do with governmental control of free speech as the european poster intimated.

Warmly,  
Padgett

From boatanchors@theporch.com Thu Mar 2 22:52:24 1995  
Date: Thu, 2 Mar 1995 18:45:26 -0600  
Message-Id: <n1417962778.98615@msmailgw1.arlut.utexas.edu>  
From: "rohre" <rohre@msmailgw1.arlut.utexas.edu>  
Subject: The why of mult-grid over triode: bias

In addition to the other fine comments posted re this: Let me point out that bias is a DC voltage, and cannot pass capacitive coupling, which was part of your premise.

That, and the other discussion is why the multi-grid evolved from the simple triode.  
People just kept thinking up things that could also be done in the same glass bulb.

The high point of this evolution was of course, the Compactron; which came along just in time to be eclipsed by the transistor and off shore produced solid state electronics. The Compactron incorporated many more tubes in one glass than the dual tubes that are better known.

From boatanchors@theporch.com Thu Mar 2 10:55:13 1995  
Date: Thu, 2 Mar 1995 08:27:20 -0600  
Message-Id: <199503021426.IAA05584@uro.theporch.com>  
From: "Stephen M. Linscott" <LINSOT@ricevm1.rice.edu>  
Subject: Re: Vacuum Tube Computers

On Wed, 1 Mar 1995 18:40:48 -0600 you said:

(deletia)

>Also, as for the octal versus hex distinction, that's only a matter of  
>human interface. In the early computer days, there was a far more

>important distinction between binary and decimal computers! The  
>business people didn't feel safe with "translating" their numbers into  
>binary, they felt it was approximate (especially floating point). So,  
>there were decimal computers, like the IBM 709. It also had no "word  
>length" at all, there was an "end of number" flag in the memory --  
>arbitrary precision. (The IBM 709 was vacuum tube, the IBM 7094  
>replaced it, with exactly the same architecture, but transistor.)  
>

Just for the record, the IBM 709 was a binary machine, as was the IBM 7090  
and 7094, with a 36 bit word length. As a beginning IBM CE, the 7090 was the  
first computer that I was trained on. We spent 3 months learning every  
circuit in the machine! The IBM 705 was a decimal tube machine. We were told  
that the 7090, pronounced seven-oh-ninety, was given that nomenclature because  
it was a 709T (transistorized). The great thing about the tube computers was  
that they were a good source of tubes for the ham. If a tube was swapped out  
and that didn't fix the problem, the old tube was NEVER put back in the  
machine. We had boxes and boxes of tubes, most of which were perfectly good.

- Steve -

```
*****  
*   Steve Linscott, Divisional Consultant - Natural Sciences   *  
*   IS User Services           Rice University, Houston, Texas *  
*****
```

From boatanchors@theporch.com Thu Mar 2 11:40:04 1995  
Date: Thu, 2 Mar 1995 08:51:37 -0600  
Message-Id: <Pine.LNX.3.91.950302075502.3472A-100000@thelair.zynet.com>  
From: johnb@thelair.zynet.com  
Subject: RE: Vacuum Tube Computers

On Wed, 1 Mar 1995, Hugh D. Stegman wrote:

>  
> Check out the Computer Museum if you're ever in Boston. They let you walk  
> around in the CPU of an early tube Whirlwind.  
>  
> "Core" really was. They had an array of ferrite cores soldered to a grid of  
> copper bus wire. If it had 4K, this was really something. Previously they'd  
> used mercury delay lines or CRT tubes that temporarily retained charges on the  
> screen.

I'm holding a DEC 8Kx18 core board (an H-215 for you DEC-philes)  
circa 1973. If any of you knowledgeable about such could drop me a line and  
explain how this was built, I'd appreciate. Ampex seems to have made  
the actual array. Its a tiny one...on a quad size panel!

/john

John M. Brewer       wb5oau  
johnb@thelair.zynet.com

From boatanchors@theporch.com Thu Mar 2 22:39:45 1995  
Date: Thu, 2 Mar 1995 19:33:31 -0600  
Message-Id: <199503021801.MAA10031@zoom.bga.com>  
From: larry wise <lewise@bga.com>  
Subject: Re: Vacuum Tube Computers

I believe the IBM 7070 (seven oh seventy) was a decimal machine...

And then there were the 1401... 1410... 7010???? series used as I/O machines for the bigger ones....

--

Larry E. Wise       lewise@bga.com  
Georgetown, Texas   KA5T  
512-863-5870

From boatanchors@theporch.com Thu Mar 2 23:50:10 1995  
Date: Thu, 2 Mar 1995 09:36:42 -0600  
Message-Id: <199503021539.KAA16325@Shiva.COM>  
From: John Shriver <jas@shiva.com>  
Subject: Re: Vacuum Tube Computers (6571 tube)

Oops, make that HB-3 6571 page be dated May 1, 1955, not 1995!!! In 1995, we only use vacuum tubes in computers to see bits as pixels!

From boatanchors@theporch.com Thu Mar 2 09:17:14 1995  
Date: Thu, 2 Mar 1995 06:57:01 -0600  
Message-Id: <9503021256.AA20774@asterix.isoft.intranet.gr>  
From: "PMD G.SIFAKIS" <pmdsif@isoft.intranet.gr>  
Subject: Re: Vacuum Tube Computers

Dube writes:

> Sitting here next to me is an "E2100 Memory" (52x26). Consisting of 4  
> core planes. The core planes are on both sides of 2 boards about 3x5  
> inches.  
> I have no idea of what computer it went with, nor when it was built.  
> but it makes interesting show-and-tell for my classes.  
>

It is amazing to me that even the brightest of today's young University

graduates and professional hackers don't know where the word "core" came from.

By the way, I'm looking for one of these core planes for a long time now, but no luck. As far as I know the last computer to use these was DEC's PDP-11 at late 70s. Core was ancient even then, but apparently DEC got a very good deal on it.

73

George SV0KA

From boatanchors@theporch.com Thu Mar 2 22:39:11 1995  
Date: Thu, 2 Mar 1995 19:36:57 -0600  
Message-Id: <2F55FB41@sharkgate.sandiegoca.attgis.com>  
From: "Kenan, Larry" <llk@sandshark.sandiegoca.ATTGIS.COM>  
Subject: Re: Vacuum Tube Computers

> Just for the record, the IBM 709 was a binary machine, as was the IBM 7090  
> and 7094, with a 36 bit word length. As a beginning IBM CE, the 7090 was the  
> first computer that I was trained on. We spent 3 months learning every  
> circuit in the machine! The IBM 705 was a decimal tube machine. We were told  
> that the 7090, pronounced seven-oh-ninety, was given that nomenclature because  
> it was a 709T (transistorized). The great thing about the tube computers was  
> that they were a good source of tubes for the ham. If a tube was swapped out  
> and that didn't fix the problem, the old tube was NEVER put back in the  
> machine. We had boxes and boxes of tubes, most of which were perfectly good.  
> Steve Linscott  
>

But how many 12AX7s (or twin triode something\_or\_others) can you use?  
Is it true that there were nearly as many twin triodes in the world as there were cockroaches?

The machine that I first learned programming on was an IBM 704 (related to the 709),  
later replaced by a 7094. The 704/7094 and 709/7090 machines were the same logic  
implemented in hollow/solid states. The impetus was to save on the cost of electricity.

The 704 was always installed with it's two part cabinet swung open like a book. The cross talk of the high impedance hollow state design would kill it when the cabinet was closed up. The first 704 was shipped with scope probes hanging on it and IBM had to do some redesign to make it work without them. There was Preventive Maintenance scheduled on the 704 at 7AM every morning. That would yield another batch of 12AX7 pull outs.

Larry Kenan

From boatanchors@theporch.com Thu Mar 2 22:54:12 1995  
Date: Thu, 2 Mar 1995 20:44:44 -0600  
Message-Id: <F32G3912.F32G3934@mail.admin.wisc.edu>  
From: TOM.A.ADAMS@mail.admin.wisc.edu  
Subject: Victory At Sea on PBS

to: boatanchors@theporch.com

Hello Jeff.

The "Victory At Sea" episodes that a lot of PBS stations are now airing are originally the product of NBC, circa 1952. The entire series should be available from your local video rental place, either as a rent or a buy; before PBS decided to repackage / reair them, Embassy Productions issued them as a six tape set (26 episodes). I have the set; it retails for around \$149.00 . I am also an engineer for Wisconsin Public Television, and we've recorded most of the series on 1" tape, to be aired at a later date (whenever the programming folks get thier feces consolidated).

Another good place to look for boatanchors that I've noticed is the various stuff that PBS airs. The "American Experience" episode on the Pearl Harbor attack had a sequence which showed a row of six foot racks stuffed with SX-28 Super Skyriders (supposedly, a military monitoring post). "Nova" has had a few excellent boatanchor shots now and again; the recent episode "The Codebreakers" showed a lot of gear (mainly British, tho there were a few AR-88s) in what was supposed to be the British intercept / crypto center at Bletchley Park. Another one was the episode "The Schoolboys Who Cracked the Russian Secret" (???), which detailed the story of an English schoolmaster who set up a satellite tracking program in his boy's school class; that one showed some beautiful British receiving gear, and a BC-221 frequency metre being used to record the Doppler shift on a pass of Sputnik I.

The all time boatanchor feast was on "Frontline", on thier report on the Walker spy ring. Among other things, a receiving compartment on a carrier that has been turned into a museum (more Collins R-390As than you can imagine), and

a few shots of R-1051s with thier associated crypto gear.

With stuff like this on, suffice it to say that I don't mind working signoff shifts here at all; it's just those damned signON shifts that are a royal pain. Barney the Dinosaur is SUCH a pain in the butt!!!

73's,

Tom, K9TA